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SOUTHWESTERN
RANGE & SHEEP BREEDING LABORATORY
FORT WINGATE, NEW MEXICO

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
COOPERATING WITH THE
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
AND THE
NEW MEXICO AGRICULTURAL EXPERIMENT STATION

1961-62 22 REPORT

THIS REPORT OF RESEARCH PROJECTS NOT YET COMPLETED IS INTENDED FOR THE USE OF ADMINISTRATIVE LEADERS AND WORKERS IN THIS OR RELATED FIELDS OF RESEARCH, AND NOT FOR GENERAL DISTRIBUTION.

ANNUAL REPORT - 1961 - 1962

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OBJECTIVES

The principle objective of this laboratory is the development of types of sheep which are adapted to the semi-arid range conditions of the Southwest, and to the economic requirements of Navajo Indians and other sheep producers of this area. In the pursuit of this objective, it has been the policy to employ basic breeding methods that can be used by other stockmen of this area. Values of the wools are studied, and the selection of breeding animals is based on production records as measured under range environmental conditions. Emphasis has been placed on adaptability and longevity of the sheep, yield of wool and its suitability for hand weaving and commercial manufacture, and the quality and quantity of lambs produced.

OUTLINE OF RESEARCH PROGRAM

In order to achieve the above objectives, the research program of the Southwestern Range and Sheep Breeding Laboratory is conducted under the authority of four research projects. Three of them deal primarily with sheep breeding, while the fourth is concerned with investigations of wool and its various qualities. These four projects provide for maximum utilization of the sheep maintained at Fort Wingate and the records obtainable from them. The four projects are as follows:

AH b1-10 Improvement of Navajo sheep by line breeding and selection within the Navajo strain.

AH b1-11 Improvement of fine wool sheep under southwestern conditions.

AH b1-12 Improvement of coarse wool sheep for the production of wool suitable for Navajo hand weaving.

AH b5-6 Investigations of wool for the improvement of Navajo, Navajo crossbred, Targhee and Targhee crossbred sheep under southwestern range conditions.

ROSTER OF PERSONNEL

Name	Title	Date entered on duty	Duties
Stanley L. Smith	Animal Husbandman	Jul. 23, 1952	Director
Earl E. Ray [1]	Animal Husbandman	Oct. 6, 1958	Genetics
Gordon L. Jessup, Jr. [2]	Animal Husbandman	Mar. 17, 1952	Sheep Investigations
Thomas H. Hall	Animal Husbandman	Aug. 4, 1961	Genetics
Alison S. Dodge	Clerk (Stenography)	June 3, 1951	Clerical
Glenn C. Perkins	Labor Lead Foreman	Sept. 24, 1954	Operations
Jimmie Gleason	Maintenance Worker	Apr. 1, 1942	Maintenance
Fred Deschene	Livestock Research Helper Leader	Oct. 2, 1947	Camp Tender
Calvin Gleason	Laborer	Sept. 4, 1956	Miscellaneous
Bahozhonie W. Begay [3]	Livestock Research Helper	Nov. 2, 1959	Sheepherder
Sam Sage [4]	Livestock Research Helper	Jan. 5, 1960	Sheepherder
Tom Gleason	Livestock Research Helper	Aug. 20, 1961	Sheepherder

1. Dr. Earl E. Ray resigned effective June 30, 1961. Holds Excepted Appointment as Collaborator without Compensation under Animal Husbandry Research Division, Sheep and Fur Animal Research Branch, Breeding and Physiology Investigations, Las Cruces, New Mexico effective September 11, 1961.

2. Gordon L. Jessup, Jr. transferred to Department of the Army, May 13, 1961.

3. Bahozhonie W. Begay resigned effective August 24, 1962.

4. Sam Sage resigned effective June 30, 1961.

PUBLICATIONS

The following papers have been published since the establishment of the Southwestern Range and Sheep Breeding Laboratory:

1. The Navajo Sheep Industry and Needs for Its Improvement:
   J. M. Cooper, The Sheep Breeder, May 1939. (Out of Print).

2. The Sheep Industry of Indians in the Southwest:
   J. M. Cooper and Dewey Dismuke, Indians at Work, August, 1939. (Out of Print).

3. Breeding for Adaptability to Local Conditions, with Special Reference to Sheep on the Navajo Indian Reservation:
   J. M. Cooper, American Society of Animal Production, 1939. (Out of Print).

4. Improvement of the Navajo Sheep:
   Cecil T. Blunn, Journal of Heredity, March 1940.

5. Breeding for Quality Wool:
   James O. Grandstaff, The National Wool Grower, July, 1940. (Out of Print).

6. A Rapid Method for Projecting and Measuring Cross Sections of Wool Fibers:
   James O. Grandstaff and Walter L. Hodde, Circular No. 590, U. S. Department of Agriculture, December 1940.

7. Evaluating Fleece Characteristics of Navajo Sheep from a Breeding Standpoint:
   James O. Grandstaff, Rayon Textile Monthly, October-November 1941.

8. Wool Characteristics in Relation to Navajo Weaving:
   James O. Grandstaff, Technical Bulletin No. 790, U. S. Department of Agriculture, January 1942.

9. Characteristics and Production of Old-Type Navajo Sheep:
   Cecil T. Blunn, Journal of Heredity, May 1943. (Out of Print).

10. The Influence of Seasonal Differences on the Growth of Navajo Lambs:
    Cecil T. Blunn, Journal of Animal Science, February 1944. (Out of Print).

11. A Preliminary Report on the Post-Natal Development of the Fiber Characteristics of the Fleeces of Navajo Sheep:
    James O. Grandstaff and Cecil T. Blunn, Journal of Animal Science, May 1944. (Out of Print).

PUBLICATIONS, CONTINUED:

12. Comparison of the Yields of Side Samples from Weanling and Yearling Sheep:
Cecil T. Blunn and James O. Grandstaff, Journal of Animal Science, May 1945.

13. Yearly Differences in Growth of Navajo and Crossbred Ewe Lambs:
Cecil T. Blunn, Journal of Animal Science, August 1945.

14. Evaluating Fleece Quality of Navajo Sheep from Small Samples:
James O. Grandstaff and Cecil T. Blunn, Journal of Agricultural Research, September 1945.

15. Improvement of Wool for Navajo Hand Weaving:
James O. Grandstaff and Cecil T. Blunn, Indians at Work, March 1945. (Out of Print).

16. Relation of Kemp and Other Medullated Fibers to Age in the Fleeces of Navajo and Crossbred Lambs:
James O. Grandstaff and Harold W. Wolf, Journal of Animal Science, May 1947.

17. Comparison of Corriedale x Navajo and Romney x Navajo Crosses:
James O. Grandstaff, Journal of Animal Science, November 1948.

18. Size of Lambs at Weaning as a Permanent Characteristic of Navajo Ewes:
George M. Sidwell and James O. Grandstaff, Journal of Animal Science, August 1949.

19. Adaptation of Livestock to New Environments:
James O. Grandstaff, for publication in Proc. United Nations Scientific Conference on Conservation and Utilization of Resources, Lake Success, New York, 1949.

20. Fertility and Reproduction in Sheep in Relation to Breeding and Environment:
James O. Grandstaff, presented at International Symposium on High Altitude Biology held at Lima, Peru, South America, November 23-30, 1949.

21. Genetic and Environmental Factors Affecting Staple Length in Navajo and Navajo Crossbred Weanling Lambs:
George M. Sidwell, James O. Grandstaff and Donald A. Price, Journal of Animal Science, February 1951.

22. Lamb Production of Navajo Ewes Bred to Columbia and Romney Rams, and Navajo Crossbred Ewes Bred to Lincoln and Cotswold Rams:
Donald A. Price, James O. Grandstaff and George M. Sidwell, Journal of Animal Science, February 1951.

PUBLICATIONS, CONTINUED:

23. Genetic and Environmental Factors Affecting Type and Condition in Navajo and Navajo Crossbred Weanling Lambs:
George M. Sidwell, Donald A. Price and James O. Grandstaff, Journal of Animal Science, May 1951.

24. Effects of Some Genetic and Environmental Factors on Yearling Traits of Navajo and Navajo Crossbred Ewes:
Donald A. Price, George M. Sidwell and James O. Grandstaff, Journal of Animal Science, November 1953.

25. Some Aspects of Twin Vs. Single Lambs of Navajo and Navajo Crossbred Ewes:
George M. Sidwell, Journal of Animal Science, February 1956.

26. Estimation of Clean Fleece Weight from Small Side Samples and from Wool Density, Body Weight, Staple Length and Grease Fleece Weight:
George M. Sidwell, Gordon L. Jessup, Jr. and W. D. McFadden, Journal of Animal Science, February 1956.

27. Some Factors Influencing Fiber Diameter in Yearling Ewe Fleeces:
George M. Sidwell and Gordon L. Jessup, Jr., Western Section Meetings of the American Society of Animal Production, Reno, Nevada, July 16-18, 1956.

28. A Comparison of Five Methods of Estimating Clean Fleece Weight:
George M. Sidwell, P. E. Neale and Gordon L. Jessup, Jr., Journal of Animal Science, August 1958.

29. Tests Reveal Importance, Influence of Large Bodied, Weighty Ewes:
Jack L. Ruttle, The National Wool Grower, October 1958.

30. Effect of Age on the Selection of Rams:
Jack L. Ruttle and George M. Sidwell. Sheep and Goat Raiser, February 1959. Also published under the title, Beware of Judging Strictly by Size, in The National Wool Grower, May 1959.

31. Feedlot Performance and Carcass Merit of Ram and Wether Lambs:
Earl E. Ray. Presented at Feeders' Day, New Mexico State University, February 1962.

32. Will the Housewife Buy Lamb? Earl E. Ray. New Mexico Stockman, July 1962.

TABLE 1. SUMMARY OF PRECIPITATION

	Fort Wingate				El Morro		
	Average 1864-1911	Average 1938-1960	1961	1962	Normal	1961	1962
January	.96	1.02	.50	1.27	.93	.95	1.03
February	1.42	.67	.69	1.61	.84	.30	.57
March	1.02	.89	1.73	.85	1.18	2.11	.69
April	.98	.66	.65	.19	.60	.65	.30
May	.58	.62	.10	.10	.41	.34	.03
June	.69	.53	.05	.54	.53	.27	.25
July	2.34	1.85	2.29	2.13	1.80	1.75	1.06
August	2.31	2.05	2.94	1.24	2.76	3.43	.51
September	1.37	1.10	.88	1.50	1.46	.34	3.49
October	1.05	1.18	2.91	2.62	1.01	2.15	1.72
November	.76	.62	.88	1.28	.52	.52	1.09
December	.97	.91	1.26	.44	1.03	1.46	.48
ANNUAL	14.45	12.10	14.88	13.77	13.07	14.27	11.22

The above table summarizes the precipitation at Fort Wingate and El Morro, New Mexico. El Morro data are presented because the ewes and lambs are grazed on range close to El Morro for a large part of the year and because there are sometimes appreciable differences in the amounts of precipitation between the two locations. Data at Fort Wingate from 1938 to the present have been compiled from station records. All other data have been secured from the U. S. Weather Bureau reports.

WEATHER CONDITIONS

1961

The year of 1961 shows an annual precipitation total of 14.88 inches, at Fort Wingate. Dispite the fact that this figure is better than average, the months of January, April, May, June and September were drier than usual and range conditions in the late spring and early summer were extremely poor.

Precipitation at El Morro was also above normal, but the months of May, June and September were far below average and, following two years of drouth, range conditions immediately after lambing were worse than any observed within recent years.

1962

Precipitation recorded at Fort Wingate during 1962 was a little over an inch above the average with an annual total of 13.77 inches. Although this amount is 1.11 inches less than that recorded in 1961, overall distribution of precipitation was better in 1962 than in the previous year. Range conditions were far better than any seen in recent years.

El Morro precipitation was nearly two inches less than the average, with an annual total of 11.22 inches. Range conditions, however, were considerably better than those of the previous year due to above normal precipitation in 1961.

SUMMARY OF OPERATIONS, 1961

The winter of 1960-61 was drier than usual, consequently, soil moisture and stock water were both low during the spring. The extremely dry condition during May and June left no grass on either the Fort Wingate range or the Bond range at Ramah. The sheep were held at Fort Wingate until after lambing in May, when they were trucked to the Bond range. In June, no forage remained so the sheep were fed three-fourths pound of 70 percent alfalfa pellets per day until early July when the rain brought new grass and weeds.

In April, the sheep were shorn in the new steel building erected the previous year. This building also serves as a lambing shed and is used for semen testing. All operations were greatly facilitated by the construction of this building.

A well was drilled in the ram pasture north of Highway 66. Water was obtained at approximately 270 feet. However, this was too salty for use, so drilling was continued to 687 feet where another water strata was found. This water was also salty but could be used for stock water. The well is free flowing at the rate of seven pints per minute.

Fencing of the third ram pasture was completed during August. This makes three enclosed pastures and should allow for rotation grazing so that no one pasture will be overgrazed. It will also be possible to turn the ram lambs loose as soon as they are weaned.

All lambs were weaned the last of August. Weaning weights averaged five to ten pounds less than 1960 due to the extremely poor range conditions. After weaning, all ram and wether lambs in breeding groups 20, 21, 22 and 23 were sent to New Mexico State University for use in a cooperative lamb carcass study. These lambs were fed out and slaughtered at the University Meats Laboratory.

Ram lambs from breeding groups 1, 13, 16 and 25 were returned to Fort Wingate and turned loose in one of the fenced pastures. In October, these lambs were culled, the culls being castrated at that time. Approximately 30 days after castration, the cull ram lambs were sold along with the cull ewe lambs as feeders.

In early November, one-third of the ewes were treated with dimethoate for control of head grubs (Oestrus ovis) by the Animal Disease and Parasite Research Division. Each ewe was weighed and

the correct dosage was calculated. However, severe toxic symptoms were noticed three-five hours after injection in about one-half of the treated ewes. In previous treatments, toxicity had been encountered, but not on such a large scale. In cases where the sheep were not weighed and incorrect dosages administered, death has occurred. For these reasons, it was decided to discontinue testing Dimethoate and try a new organic phosphate compound, CA 3208. Enough CA 3208 was obtained to treat 30 ewes. This was done during December. No break occurred in the wool and the lambing percentage of the treated ewes appeared to be as good as non-treated ewes. Further testing of head grub control compounds is scheduled in cooperation with the Animal Disease and Parasite Research Division.

Semen testing of all rams to be used in the breeding program was conducted in November.

The last week of November, the ewe herd was trucked back from the Bond range to Fort Wingate. On December 6, breeding began. A total of 871 ewes were in the breeding pens.

The ram lambs were brought into the corrals about the middle of December and put on alfalfa hay. The ewe lambs remained on the range, but received a supplement of one-third pound of 70 percent alfalfa pellets per day.

During the fall permission was given to use all of the protective border area of the Fort Wingate Ordnance Depot for sheep range. This makes a total of 3950 acres which the Army has made available for use. The range lies immediately west of the Laboratory and will be used as winter range for the ewe herd. It is anticipated that all the sheep can now be wintered from breeding to lambing at Fort Wingate and the Bond range used entirely as a summer range.

SUMMARY OF OPERATIONS, 1962

The winter of 1961-62 was extremely wet. The month of February was the wettest February ever recorded at the Sheep Laboratory. When the snow melted, run-off water washed out many dams and considerable work was necessary to keep from losing others.

The ewe herd was maintained from breeding to lambing on the Fort Wingate Ordnance Depot range, plus some Sheep Laboratory range. The ewe lambs and mature rams utilized the remainder of the laboratory range. The ram lambs were kept on feed in a corral until shearing. The mature ewes received one-fourth pound of alfalfa pellets per day and the ewe lambs one-third pound until May 1.

In April, a field day was held in conjunction with shearing. This field day was also a celebration of the Centennial year of the United States Department of Agriculture. All USDA activities in the county were represented in the program. An educational program concerning sheep improvement was presented by Laboratory personnel.

The ewes were trucked to the Bond range in May as soon as their lambs reached two weeks of age. During June, all mature sheep and lambs were vaccinated for bluetongue and the lambs vaccinated for soremouth, also.

Due to an outbreak of scabies in New Mexico, it was necessary to dip all sheep during July. The Laboratory sheep were dipped in a lindane solution under supervision of Animal Disease Eradication Division personnel. Two weeks after dipping, twenty-two lambs and eight ewes were found dead. Death could not be directly attributed to dipping. Previous experience has shown death from lindane poisoning to occur within 48 hours.

The New Mexico Wool Growers visited the Sheep Laboratory during August as part of their annual Sheep Ranch Tour. An explanation of work currently in progress was given and a demonstration of epididymitis detection in rams was conducted.

The last week of August, the lambs were weaned. Ram lambs in groups 1, 13, 16 and 25 were returned to the Fort Wingate range and turned loose in a fenced pasture. Ram and wether lambs from groups 20, 21, 22 and 23 were shipped to New Mexico State University for use in the cooperative lamb carcass project there.

Lamb weights at weaning averaged five to ten pounds heavier per line than in 1961. This is a direct reflection on the improved range conditions during the summer of 1962.

Culling of lambs, ewes and rams was done in late September and early October. The cull ram lambs were castrated, then sold in November with the cull ewe lambs as feeders.

All rams were semen tested during November. The ewes were trucked from the Bond range to Fort Wingate during the last week of November.

The months of September, October and November were warm. Considerable moistrue also occurred during this period with the result that the ranges were in very good condition. Green grass and weeds were still available until mid-December. The ram lambs were not put on feed until January 15 because of the open weather and the good feed available.

The ewes were put in breeding pens during the first week of December. Breeding began on December 6. On December 20, all rams were checked for epididymitis. Three suspect rams were removed from the breeding pens and replacements put in.

TABLE 2. OUTLINE OF BREEDING PROGRAM

Breeding group designation		Breeding of rams	Breeding of ewes	No. of rams each year	Number of ewes Breeding season		Research line project
No.	Letter				1960-61	1961-62	
1	N	Navajo	Navajo	3	105	101	AH-bl-10
13	F	Finewool	Finewool	4	132	145	AH-bl-11
25	T	Targhee	Targhee	4	79	74	AH-bl-11
22	D	Targhee	Targhee x Reservation	10	133	110	AH-bl-11
21	R	Rambouillet	Rambouillet x Reservation	10	124	112	AH-bl-11
20	S	Reservation	Reservation	10	107	107	AH-bl-11
16	C	Coarsewool	Coarsewool	4	120	112	AH-bl-12
23	L	Coarsewool	Coarsewool x Reservation	10	107	110	AH-bl-12
Totals				55	907	871	

SUMMARY OF BREEDING PROGRAM

The Navajo breeding group of sheep are descended from the original old type Navajo sheep obtained by the Laboratory in 1935. They have been maintained as a closed line with improvement derived entirely through selection.

The Coarsewool breeding group is made up of the offspring from the following matings and the reciprocals thereof:

$$(K \times N)[C_2 \times \begin{matrix}(C_1 \times N)(R_1 \times N)\\(R_1 \times N)(C_1 \times N)\end{matrix}] \times [L \times \begin{matrix}(C_1 \times N)(R_1 \times N)\\(R_1 \times N)(C_1 \times N)\end{matrix}] (R_1 \times N).$$

Breed Symbols

C_1 - Corriedale	L - Lincoln
C_2 - Cotswold	N - Navajo
K - Columbia	R_1 - Romney

This line has been closed since 1954 when final crosses were completed. Further improvement will be based on selection and breeding within the line.

The Finewool breeding group is composed chiefly of the offspring of Targhee rams bred to $(C_1 \times N)(R_1 \times N)$ and $(R_1 \times N)(C_1 \times N)$ ewes. It also contains offspring of Debouillet and Merino rams bred to the same type ewes and Rambouillet rams mated to Navajo ewes. This line has also been closed since 1954 when final crosses were completed. Improvement will be continued by selection and matings within the line.

Group 25 is of purebred Targhee breeding. One hundred ewes were purchased in Idaho and Montana, and first bred in 1954. This line has been slow to adapt to New Mexico conditions, with the result that it has been difficult to maintain numbers. Rams representing several inbred and control lines were obtained from the U. S. Sheep Experiment Station, Dubois, Idaho to serve the dual purpose of improving the Fort Wingate sheep and of testing the lines produced at Dubois. Starting with the 1961-62 breeding season, Targhee rams born and raised at Fort Wingate have been used to increase adaptability.

Ewes in breeding groups 20, 21, 22 and 23 are the offspring of average Navajo Reservation ewes obtained in 1952-53. The original ewes were predominantly of low grade Rambouillet or Merino breeding.

SUMMARY OF BREEDING PROGRAM, CONCLUDED.

Breeding group 20 is used as a control. The rams are of the same breeding as the ewes. In group 21, the rams are good quality Rambouillets obtained from the Navajo Tribal Ram flock, at Sanders, Arizona. The rams used in group 22 are purebred Targhees, and are produced at Fort Wingate in breeding group 25. Rams used in group 23 are of coarsewool breeding and produced at Fort Wingate in group 16.

Selection in groups 21, 22, and 23 is on the ewe side only. All ram lambs are discarded, and new rams of designated breeding are used each year. In the control group (group 20), selection of both rams and ewes is made at random in an attempt to prevent genetic gain or loss.

INCREASED PRODUCTION THROUGH TOPCROSSING

The increase in production through topcrossing with sires from improved lines was studied. Four hundred unimproved yearling ewes from the Navajo reservation were divided at random into four breeding groups. Topcrossing with improved sires was carried on in three of the groups. In group 22, Targhee sires were used; in group 23, weaving wool type sires were used; in 21, high grade Rambouillet type sires were used and in group 20, the sires are selected at random from progeny of the line. Group 20 is used as a control and is handled so that no genetic gain or loss occurs.

Over a period of three generations, the average two year old clean fleece weight of the three groups using improved sires increased by over two pounds. During this same period, staple length at two years of age increased two centimeters in groups 20 and 21 while group 23 showed an increase of over four centimeters.

The control group (20) showed an increase of one pound in clean fleece weight and one centimeter in staple length through three generations. The greater portion of these control line increases occurred in the first generation and could be due to the improved environment experienced at Fort Wingate as opposed to the Navajo reservation. The original ewes were purchased when six to twelve months of age and as such were subjected to the stresses of the reservation for most of their first year of life, whereas the first generation ewes were born and reared at the Laboratory. Some of these environmental differences may have carried over into the two year old records.

Groups 22 and 23 exhibited an increase in weaning weight of 13 pounds, while group 21 increased 10 pounds through four generations. The control group (20) showed no appreciable gain in weaning weight during this period.

Clean fleece weight, staple length and weaning weight by breeding group and generation are shown in the following table.

CLEAN FLEECE WEIGHT OF TWO YEAR OLD EWES (lbs.)

	Breeding Group			
Generation	22	23	21	20
Original	2.04	2.01	1.95	2.04
1	4.10	4.20	3.91	3.02
2	4.49	4.46	4.05	3.29
3	4.19	4.15	4.45	3.20

STAPLE LENGTH OF TWO YEAR OLD EWES (cms.)

	Breeding Group			
Generation	22	23	21	20
Original	5.28	5.32	5.75	5.22
1	7.21	8.05	7.10	5.66
2	7.37	9.76	7.62	5.72
3	7.20	12.40	8.10	6.25

WEANING WEIGHT OF LAMBS (lbs.)

	Breeding Group			
Generation	22	23	21	20
1	57.3	56.9	54.1	54.6
2	63.2	63.5	59.9	58.7
3	67.7	66.2	64.6	58.4
4	70.3	69.9	64.4	55.9

IMPLANTING TESTOSTERONE - ESTRADIOL BENZOATE INTO EWE LAMBS

A preliminary investigation concerning the effect of implanting testosterone-estradiol benzoate pellets into ewe lambs was conducted in cooperation with New Mexico State University. The primary concern was to determine if testosterone estradiol benzoate implants would stimulate growth after weaning so that the carcass would contain less trimmable fat after the ewe lambs had been in the feedlot.

Three levels of implant were used while a fourth lot of ewe lambs received no implant. The average daily gain from weaning to slaughter was decidedly higher for the implanted lambs. Overall daily gain averaged 11 percent greater for the implanted lambs. The non-implanted lambs required an average of 30 days longer to reach a slaughter weight of 95 pounds. The implanted lambs required an average of 35 percent less feed per pound of gain than the non-implants.

The live grade and carcass grade averaged the same for all lots. The pounds and percent of trimmable fat were both higher for non-implanted lambs. Implanted lambs had less caul and ruffle fat while all lambs had essentially the same fat thickness over the loin.

Further testing with larger numbers of ewe lambs is scheduled. Results of this preliminary work indicate a significant response to the implants and also indicate that further study would be justified.

FEEDLOT PERFORMANCE AND CARCASS MERIT OF RAM AND WETHER LAMBS

A study was conducted in cooperation with New Mexico State University concerning feedlot performance and carcass merit of ram and wether lambs. The ram lambs averaged 2.5 pounds heavier at weaning and 3.4 pounds heavier at slaughter even though they reached slaughter age five days sooner than wether lambs. The ram lambs required less feed per pound of gain, made a faster rate of gain and produced more pounds of retail trimmed meat per day of age. These results show ram lambs to be the most desirable from the breeders' standpoint; however, it is doubtful if this would be true on the market since buyers are purchasing lambs on the basis of dressing percentage, not cutability.

MARKETING LAMB CARCASSES

Lamb carcasses from the carcass merit study conducted in cooperation with New Mexico State University were sold through a local supermarket. This supermarket had been selling about three lambs per week through it's large self-service meat counter. During a six week period in the fall, this supermarket sold 82 lambs from the carcass merit study; an increase of 456 percent.

The success of marketing these lambs was attributed to (1) lean carcasses which result in retail cuts that need little trimming, (2) young, tender, juicy cuts, (3) appealing packaging by the supermarket, (4) fresh supply of lamb, and (5) retailed cuts were all trimmed to 1/8th of an inch of fat which the customer evidently liked very well.

The results show that young, heavy-not fat, meaty, and not overfinished lamb carcasses will sell well. Most carcasses on the market at the present are heavy because of too much fat and not enough lean, saleable meat after the fat is removed. These overfat carcasses result in a retailer having to remove too much fat resulting in too high a price on the remaining lean meat.

IMPROVEMENT OF NAVAJO SHEEP BY LINE BREEDING AND SELECTION WITHIN THE NAVAJO STRAIN

The Navajo sheep are important in this area because they have survived several centuries of virtually natural selection under arid southwestern conditions. They are therefore well adapted to this environment in their ability to live and reproduce under sparse feed conditions. Since there is no longer available any other source of Navajo sheep, it is important to preserve and improve these sheep for use in crossbreeding and for developing highly productive sheep adapted to this area.

CHARACTERISTICS OF NAVAJO BREEDING RAMS

Number of rams used, age at lambing, and body weight and fleece characteristics at yearling age are presented in table 3. The data are averaged by five year periods from 1947 to 1961 and by years for 1961 and 1962.

TABLE 3. YEARLING TRAITS OF NAVAJO BREEDING RAMS

Year	No.of rams	Age at lambing (years)	Body weight (lbs.)	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	U.S. grade	Staple length (cms.)	Medullated fibers (percent)
1947-51	20	3.1	112.7	7.13	4.62	48s	15.9	0.5
1952-56	22	3.0	105.9	5.56	3.44	54s	10.7	0.4
1957-61	15	2.1	112.4	5.33	3.22	60s	10.3	0.1
1961	4	2.3	120.0	5.68	3.25	54s	10.6	0.0
1962	3	2.3	124.0	6.98	4.04	54s	11.4	0.1

The rams used for breeding in 1961 and 1962 showed an increase in all yearling traits over the average of rams used during the previous ten years. The greatest advances have occurred in body weight and in the reduction of medullated fibers. Grade of the fleeces has remained in the 3/8's classification. Fleece weights are rising steadily. A drop in fleece weights and shortening in staple length occurred during 1952 to 1961. However this was due to an intensive selection against medullated fibers and kemp. The percentage of kemp has become so small that it is no longer recorded.

CHARACTERISTICS OF NAVAJO BREEDING EWES

Yearling body weight, yearling fleece and fiber traits, and age at lambing are presented in table 4 for the Navajo breeding ewes. These data are averaged by five year periods from 1947 to 1961, and by years for 1961 and 1962.

TABLE 4. CHARACTERISTICS OF NAVAJO BREEDING EWES AS YEARLINGS

Year	No. of ewes	Age at lambing (years)	18 Month weight (lbs.)	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	U. S. grade	Staple length (cms.)	Medullated fibers (percent)
1947-51	660	5.5	99.7	5.27	3.44	58s	10.0	1.2
1952-56	582	4.8	97.2	5.05	2.92	58s	10.4	1.2
1957-61	501	3.9	96.6	4.13	2.62	60s	9.4	0.04
1961	105	4.1	99.9	4.43	2.72	58s	9.4	0.09
1962	101	3.6	100.5	4.47	2.78	56s	9.5	0.06

The Navajo ewes bred to lamb in 1961 averaged slightly older than those of the previous five years. In 1962, the average age was 3.6 years, the youngest recorded to date.

An increase in selection pressure has caused body weights to increase an average of 3-4 pounds at 18 months of age.

Staple length and fleece weights have begun to increase slowly. These two traits had been decreasing due to selection pressure being applied toward reduction of kemp and medullated fibers. Kemp has been reduced to the point where it is no longer reported. Medullated fibers have been reduced to less than one tenth of one percent. Since little selection pressure need be directed toward kemp and medullated fibers, more can be applied to body weight, fleece weight and staple length.

LAMB PRODUCTION OF NAVAJO MATINGS

Lamb production in the Navajo line is summarized in table 5. For the years 1937 through 1951, the percentage of ewes lambing was based on the number of ewes bred, but from 1952 to date, it is based on the numbers of ewes bred and still in the flock at lambing time. In this way, the percentage of ewes lambing is an indication of fertility that is not confounded with past breeding death losses. The figure is affected by the fertility of both rams and ewes. The percentage of lambs born of ewes lambing is based on all lambs born, whether dead or alive, of those ewes actually having lambs. This value minus 100 gives the percentage of ewes having twins. The percentage of lambs weaned of live lambs born is a measure of lamb survival from birth to weaning, and the percentage of lambs weaned of ewes bred is a combination of the first three values plus any effects of ewe loss after weaning. The average weaning weights for the years 1937 through 1946 are unadjusted for any measurable environmental effects, and represent a growth period of about 140 days. Beginning in 1947, the weaning weights are adjusted to a constant age of 120 days and are corrected for type of birth and rearing of the lamb and age of the dam.

The percentage of ewes lambing has risen steadily since 1952. The percentages prior to 1952 are not comparable to those from 1952 to present because of the difference in computation as noted above. The drop in percentage of lambs born of ewes lambing may be due to the younger average age of the ewes, as noted in table 4. It appears that younger ewes have twins less often.

Average weaning weight has increased steadily since 1947. Weights prior to 1947 are not adjusted for any environmental effects and therefore are not strictly comparable to present weights. Pounds of lamb per ewe bred has also increased steadily except for 1962. This is due to fewer twins being born in 1962.

TABLE 5. LAMB PRODUCTION OF NAVAJO MATINGS

Year	No. of ewes bred	Percent[a] of ewes lambing	Percent lambs born of ewes lambing	Percent lambs weaned of ewes bred	Percent lambs weaned of lambs born alive	Average[b] weaning weight (lbs.)	Pounds of lamb per ewe bred
1937 - 41	1745	88.3	125.2	97.3	92.5	57.0	55.4
1942 - 46	852	88.6	148.2	109.7	84.4	58.1	63.8
1947 - 51 [c]	660	80.8	136.8	79.8	72.7	48.8	43.3
1952 - 56	580	90.0	127.0	100.9	92.9	54.8	55.2
1957 - 61	502	92.8	124.9	106.4	92.9	56.4	59.9
1961	105	94.4	126.2	104.5	93.5	59.1	64.7
1962	101	95.0	115.6	107.8	93.6	59.4	60.6

a/ Percent of ewes lambing of ewes bred for the years 1937 - 1951, but percent of ewes lambing of ewes bred and present at lambing for years 1952 - 1962.

b/ Unadjusted prior to 1947. From 1947 to present, these weights are adjusted to 120 days of age and corrected for type of birth and rearing and also, age of dam.

c/ The low value for percent of lambs weaned and average weaning weights for the 1947 - 1951 period is due, partly, to: (1) use of a sterile ram in 1950, and (2) severe death losses of ewes and lambs due to a hail storm in 1951.

NAVAJO WEANLING LAMBS

Fleece and body traits of Navajo weanling lambs are presented in tables 6 and 7. Weanling lambs are scored by a committee of Animal Husbandmen at weaning time, in September. Weaning weights and the average committee scores for type and condition are adjusted to a constant age of 120 days, and for the effects of age of dam and type of birth and rearing of the lamb. Face covering scores are not adjusted. Scoring may vary slightly from year to year, because the committee members are not always the same. The scores taken in any one year, however, can be used to compare different groups of lambs, since all lambs are scored by the same committee in any one year.

Staple length has been adjusted to a constant age of 120 days for all years shown. Although rigid selection has been practiced against kemp and medullated fibers, a small number of lambs are encountered each year that have some of these objectionable fibers.

A slow but consistent gain in weaning weight is shown from 1952 through 1962. However, range conditions and other environmental factors greatly influence weaning weight and body condition score. Navajo lambs are uniformly poor in type, having a thin and upstanding conformation. They are slow to fatten externally, but store a considerable amount of visceral fat.

During the last ten years the ram lambs have averaged about six pounds heavier than the ewe lambs at weaning. Sex differences do not appear to be so consistent or marked in other traits. Face scores have varied the least between sexes and between years. The typical Navajo lamb is well open-faced, and seldom has wool below the eyes. Once adequate vision is established, (a score of 3.0 or less), there is no advantage to applying selection pressure toward increasingly open faces.

TABLE 6. FACE AND BODY TRAITS OF NAVAJO WEANLING LAMBS

Year	Sex	No.of lambs weaned	Weaning weight (lbs.)	Body type score	Body condition score	Face covering score	Color score
1952-56	Rams	312	57.09	3.27	3.40	2.33	1.71
	Ewes	276	52.22	3.14	3.22	2.30	1.96
1957-61	Rams	262	59.59	3.16	3.52	2.19	1.69
	Ewes	267	53.46	3.22	3.55	2.34	1.86
1961	Rams	54	61.97	2.49	2.57	-	1.91
	Ewes	57	56.64	2.51	2.67	-	1.70
1962	Rams	43	63.37	3.35	3.14	2.84	1.86
	Ewes	60	56.54	3.26	3.12	2.70	1.40

TABLE 7. FLEECE CHARACTERISTICS OF NAVAJO WEANLING LAMBS

Year	Sex	No. of lambs weaned	Staple length (cms.)	Fiber diameter (microns)	Medullated fibers (percent)	Kemp fibers (percent)
1952-56	Rams	312	5.21	28.0	2.40	.34
	Ewes	276	5.19	28.8	3.13	.56
1957-61	Rams	262	5.37	27.9	.58	.03
	Ewes	267	5.48	29.1	.84	.02
1961	Rams	54	6.31	28.8	.98	- *
	Ewes	57	5.77	29.4	1.89	-
1962	Rams	43	4.98	27.5	.00	-
	Ewes	60	5.77	28.8	.15	-

* Kemp fibers are no longer counted.

SELECTION OF NAVAJO WEANLING LAMBS

Selection differentials, relative emphasis placed on each trait, and the expected genetic gains per generation for the Navajo weanling lambs for the years 1961 and 1962 are reported in Table 8. The selection differential is the difference between the average of the selected lambs and the average of all lambs from which they were selected. The relative emphasis placed on each trait is obtained by dividing the selection differential by the standard deviation. The expected genetic gain per generation, when selection is practiced in one sex, is one-half the heritability times the selection differential. When selection is practiced in both sexes, the expected genetic gain per generation is the sum of the values of both sexes.

For those traits measured by scores, the signs have been reversed, so that the selection differentials indicated how much better (positive) or poorer (negative) the average of the selected lambs were than the average of all lambs weaned. For those traits measured quantitatively (weaning weight, staple length, fiber diameter), the signs remain untouched, so that a positive selection differential indicates that the average of the selected lambs was greater than the average of all lambs weaned.

In 1961 and also 1962, the greatest emphasis was placed on weaning weight in selecting weanling lambs. In 1962, staple length received a considerable amount of attention. In previous years, staple length had been decreasing due to selection against the long, hairy outercoat found in the old-type Navajo sheep.

TABLE 8. SELECTION PRACTICED ON NAVAJO WEANLING LAMBS

	Year	Sex	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Color score	Percent saved
Heritabilities			0.21	0.04	0.11	0.06	0.30	0.46*	-	
Selection differential	1961	Rams	3.58	- .10	0.10	- .054	0.60	-	0.11	20%
Relative emphasis			0.6044	- .3180	0.1819	- .0437	0.2063	-	0.1718	
Expected genetic gain			0.3759	- .0020	0.0055	- .0016	0.0900	-	-	
Selection differential		Ewes	0.86	0.00	0.04	- .054	0.24	-	0.07	67%
Relative emphasis			0.1495	0.00	0.1228	- .0912	0.0801	-	0.0957	
Expected genetic gain			0.0903	0.00	0.0022	- .0016	0.0360	-	-	
Selection differential	1962	Rams	5.47	0.04	0.08	0.42	0.00	0.31	0.28	23%
Relative emphasis			0.6422	0.1340	0.2400	0.3774	0.00	0.4058	0.4011	
Expected genetic gain			0.5743	0.0008	0.0044	0.0126	0.00	0.0713	-	
Selection differential		Ewes	4.26	0.03	- .03	0.58	- .11	0.23	- .02	43%
Relative emphasis			0.5682	0.0805	- .2147	0.4383	- .0444	0.3417	- .0325	
Expected genetic gain			0.4473	0.0006	- .0012	0.0174	- .3720	0.0529	-	

* Heritability estimate for face covering score obtained for range Targhee and Columbia lambs at the U. S. Sheep Experiment Station, Dubois, Idaho.

YEARLING NAVAJO TRAITS

Characteristics of Navajo yearling rams and ewes are presented in Tables 9 and 10. Body weights and type and condition scores are taken in June when the sheep are approximately 400 days of age, while the other scores and measurements are taken in April, a few days before shearing. From 1947 to 1956 inclusive, clean fleece weights were estimated by scouring small samples of wool taken from the middle of the left side. Beginning in 1957, the clean fleece weights have been estimated by means of the Neale fleece squeeze machine. Data on the rams have not been adjusted for any environmental factors. In the ewe data, body weight, type score, condition score, staple length, and grease and clean fleece weights are adjusted for age of dam and type of birth and rearing. In addition, body weight is adjusted to a constant age of 400 days, while staple length and fleece weights are corrected to a constant age of 365 days.

Increased selection for heavier body weights during 1960 and 1961 resulted in heavier body weights for the 1961 and 1962 yearlings. Better body type and body condition scores accompanied the weight increase. The average color score and the average face score have decreased somewhat during this period. However, the face score remains at an entirely adequate level, since a score better than three is open faced. Additional selection pressure will have to be focused on the color problem due to the increased amount of color which appeared when selection was relaxed.

In the early work with Navajo sheep, most of the selection intensity was aimed at removing colored, as well as kempy and medullated fibers from the fleece. This resulted in smaller sheep with shorter, finer, lighter weight wool. During the last five years, it has been possible to place more emphasis on body weight, fleece weight, staple length, and coarser fiber because medullated fibers no longer required a great amount of selection pressure. The results of this switch in selection emphasis can be seen in Tables 9 and 10. Both rams and ewes are heavier, have longer, coarser wool with heavier fleece weights. Kemp and other medullated fibers have remained at a low level in spite of relaxed selection pressures.

TABLE 9. BODY WEIGHTS AND SCORES OF NAVAJO YEARLING SHEEP

Year	No.of sheep	Body weight (lbs.)	Body type score	Body condition score	Face covering score	Color score
			YEARLING RAMS			
1947-51	41	106.0	2.93	2.90	2.43	1.29
1952-56	41	103.1	3.13	3.06	1.57	1.17
1957-61	56	111.0	3.13	3.12	1.85	1.27
1961	7	123.6	2.26	2.29	1.95	1.33
1962	9	120.0	2.56	2.55	2.11	1.42
			YEARLING EWES			
1947-51	241	53.6*	2.96	2.81	2.40	1.65
1952-56	129	70.9	3.12	3.13	1.77	1.62
1957-61	161	83.1	3.23	3.24	1.97	1.57
1961	32	79.3	2.97	3.15	2.22	1.57
1962	35	84.7	2.70	2.66	2.37	2.10

* The 1947-1951 average is pulled down below normal by the extremely poor year of 1951.

TABLE 10. FLEECE CHARACTERISTICS OF NAVAJO YEARLING SHEEP

Year	No. of Sheep	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber diameter (microns)	Staple length (cms.)	Outer-coat score*	Medullated fibers percent
			YEARLING RAMS				
1947-51	41	6.40	3.95	29.6	12.8	2.56	.67
1952-56	41	4.84	3.06	26.1	9.6	1.93	.03
1957-61	56	5.18	3.15	26.4	10.6	1.67	.07
1961	7	6.19	4.03	30.2	10.4	1.07	-
1962	9	6.12	4.08	29.2	12.2	1.50	.05
			YEARLING EWES				
1947-51	241	5.64	3.51	27.1	11.4	3.13	1.91
1952-56	129	4.27	2.69	24.7	9.8	2.94	.33
1957-61	161	4.67	2.88	26.7	9.6	1.68	.08
1961	32	4.47	2.99	27.6	10.0	1.31	-
1962	35	5.28	3.40	28.4	11.1	2.20	.00

* Scores for outercoat not taken prior to 1949.

RESEARCH PROJECT AH bl - 11

IMPROVEMENT OF FINE WOOL SHEEP UNDER SOUTHWESTERN CONDITIONS

The objective of this project is to test the adaptability and usefulness of Targhee and other breeds of fine wool sheep under southwestern conditions, and to evaluate and demonstrate fine wool sheep improvement practices to Navajo sheep producers. Production of wool and lambs by Navajo stockmen has generally been lower than the average produced by commercial stockmen in New Mexico and Arizona. It is estimated that about 10 percent of the total reservation wool production is used for hand manufacture of rugs, while the remaining 90 percent is sold on the domestic market, often at an appreciable discount due to inferior quality. Crosses of Targhee rams on Navajo and Navajo crossbred ewes have shown improvement in both quality and quantity of lamb and wool produced. It is important to determine if these gains can be maintained by purebred Targhee sheep. Furthermore, it is essential to demonstrate to Navajo stockmen the procedures to be followed and the gains to be made from using improved sires in a consistent breeding program.

Three distinct lines of breeding are included in this project. Breeding group 13 was developed by mating Targhee rams to Navajo crossbred ewes. Breeding groups 20, 21, and 22 are composed of average Navajo reservation ewes mated to average reservation rams, Rambouillet rams obtained from the Navajo Tribal Ram Pasture enterprise, and purebred Targhee rams, respectively. Group 25 is a pure line of Targhee sheep. Emphasis in this project is placed on staple length, fineness, clean fleece weight, freedom from kemp and medullated fibers, adaptability, and lamb production. As a result of selecting for the above traits, it is hoped to develop an animal that will produce a maximum amount of wool of a suitable quality and lambs that will meet the requirements of feed lot operations. The combination of these factors should produce a maximum return on sheep investments.

FINEWOOL BREEDING FLOCK

The characteristics of the finewool rams used for breeding in 1961 and 1962 are presented in table 11. It is interesting to note that the crossbred Targhee rams in group 13 were heavier at yearling age than all other rams, although the purebred Targhee rams of groups 22 and 25 will average from 20 to 50 pounds heavier than the crossbreds at mature ages. Group 20 is the control group, and shows only slight differences between years.

Characteristics of the finewool breeding ewes are presented in table 12. Inasmuch as the majority of the ewes were bred in both 1961 and 1962, there is very little difference in the averages for these two years. Since 1955 however, there has been a gradual increase in 18 months body weight, grease fleece and clean fleece weights, and staple length. Wool fineness has remained practically constant however, while medullated fibers have been reduced to approximately 0.01 percent and are no longer reported.

Of the five breeding groups, line 13 has the longest and coarsest fibers and heaviest fleece weights, while line 20, which is the unselected group, has the shortest staple and lightest fleece and body weights. The purebred Targhee ewes (line 25) have the heaviest body weights. Average age of the breeding ewes has also increased due to the necessity of keeping the foundation ewes in the flock during these early years of this project.

TABLE 11. CHARACTERISTICS OF FINEWOOL BREEDING RAMS

Year and breeding group No.	No. of rams	Age at lambing (years)	Yearling body wt. (lbs.)	Yearling fleece weights Grease (lbs.)	Yearling fleece weights Clean (lbs.)	Yearling fiber traits at side Staple length (cms.)	Yearling fiber traits at side Fiber diameter (microns)	Yearling fiber traits at side U.S. grade
1957-61								
Group 13	16	2.1	124.9	8.23	4.39	9.76	23.8	62's
20	50	2.0	100.6	5.43	2.60	5.18	20.08	70's
21*	50							
22	49	3.0	112.6	9.66	4.70	8.47	21.27	70's
25	28	2.9	113.4	11.38	5.48	9.29	23.49	62's
1961								
Group 13	4	2.0	144.2	9.54	4.63	10.4	27.3	56's
20	10	2.0	115.2	6.07	2.79	5.4	22.3	64's
21*	10							
22	10	2.4	132.9	8.76	4.17	8.6	22.8	62's
25	6	2.5	119.0	11.07	5.40	9.1	25.9	60's
1962								
Group 13	4	2.0	128.7	9.01	5.83	9.5	22.4	64's
20	11	2.4	107.4	5.78	3.43	6.2	20.7	70's
21*	10							
22	10	2.2	124.2	8.72	4.67	8.5	21.4	70's
25	4	2.0	119.5	8.96	5.29	9.0	21.1	70's

* Rams in group 21 were obtained from a private breeder, so yearling records are not available.

TABLE 12. CHARACTERISTICS OF FINEWOOL BREEDING EWES

Year and breeding group No.	No. of ewes	Age at lambing (years)	18 Mos. body wt. (lbs.)	Yearling fleece weights		Yearling fiber traits at side		
				Grease (lbs.)	Clean (lbs.)	Staple length (cms.)	Fiber diameter (microns)	U.S. grade
1961								
Group 13	131	3.8	105.4	6.38	3.08	8.1	22.0	64's
20	107	3.8	99.7	5.47	2.47	5.2	21.3	70's
21	122	3.9	103.5	6.42	2.79	6.6	19.2	70's
22	133	3.9	106.6	6.16	2.91	6.5	20.6	70's
25	79	4.2	109.8	6.13	2.91	6.9	20.4	70's
1962								
Group 13	145	3.6	107.1	6.51	3.11	8.2	22.7	64's
20	105	3.3	100.6	5.36	2.47	5.2	21.3	70's
21	111	3.8	105.5	6.82	2.92	6.8	19.6	70's
22	109	3.4	107.8	6.42	2.98	6.8	21.4	70's
25	74	3.9	109.1	6.18	2.94	7.0	21.1	70's
Totals and Averages								
1955	431	3.4	96.3	5.19	2.14	6.1	-	70's
1956	432	3.4	97.4	5.00	2.11	5.8	-	70's
1957	373	3.9	102.5	5.08	2.25	6.1	-	70's
1958	483	3.5	101.4	5.54	2.52	6.4	-	70's
1959	510	3.9	101.7	5.73	2.68	6.5	19.9	70's
1960	538	3.9	101.6	5.84	2.70	6.7	20.0	70's
1961	572	3.9	104.8	6.14	2.84	6.7	20.7	70's
1962	544	3.6	105.9	6.29	2.90	6.9	21.3	70's

Characteristics of finewool breeding ewes are presented in Table 12. Since 1955, there has been a steady increase in 18 month body weight, yearling fleece weights and staple length. Average fiber diameter has gotten a little coarser, but not enough to change the grade of the wool. Medullated fibers have been reduced to less than 0.01 percent and are no longer reported.

Group 13 has the longest, coarsest wool and heaviest clean fleece weights. Group 20, the unselected control, has the lightest fleece weights, and shortest wool. No improvement has been shown by this line since no selection pressure is applied. Average age of the ewes at lambing decreased in 1962 due to the heavy culling of old ewes during the extremely dry year of 1961.

Table 13 summarizes the lamb production of the five lines of finewool ewes. The percentage of ewes lambing is based on the number bred and still present at lambing time. Percentage of lambs born includes all lambs, whether dead or alive. This figure minus 100 gives percentage of twinning. The percentage of lambs weaned of lambs born alive indicates rate of lamb survival from birth to weaning.

Percent of ewes lambing dropped sharply in 1962. This was due to use of two infertile rams. However, the percent of lambs born of ewes lambing was higher than any previously recorded. During the last few years, group 25, the purebred Targhees, have been hampered by the environment. In 1961, all Targhee ewes which lambed were ones which had been born at Fort Wingate; none of the original ewes purchased in Idaho and Montana remained. Apparently, the Targhees are becoming acclimated because they are approaching, or exceeding, other lines in production.

TABLE 13. LAMB PRODUCTION OF FINEWOOL MATINGS

Year and breeding group No.	No. of ewes bred	Percent of ewes lambing	Percent lambs born of ewes lambing	Average birth weight (lbs.)	Percent lambs weaned of: Ewes bred	Percent lambs weaned of: Lambs born alive	Average weaning weight (lbs.)	Pounds of lamb per ewe bred
1961								
Group 13	131	92.4	119.0	9.7	103.8	95.1	63.4	65.8
20	107	97.2	129.8	8.7	118.7	94.8	55.1	63.4
21	122	77.1*	124.4	9.3	91.8	96.5	58.8	54.0*
22	133	85.0	129.2	9.9	99.2	92.3	62.2	61.7
25	79	83.5	122.7	9.8	92.4	91.3	64.6	59.7
1962								
Group 13	145	66.2*	128.1	9.7	80.0	96.7	61.9	49.5*
20	105	77.1*	130.9	9.2	90.5	90.5	54.0	48.8*
21	111	84.7	124.5	9.5	96.4	93.9	59.1	56.9
22	109	94.5	125.2	10.5	110.1	93.8	62.3	68.5
25	74	85.1	129.4	10.1	90.5	87.0	63.0	57.1
Totals and averages								
1955	431	82.8	105.1	7.9	60.0	68.1	54.5	32.5
1956	432	89.1	107.0	9.0	82.4	86.6	63.0	51.8
1957	373	91.6	106.9	8.9	86.4	90.8	63.3	54.6
1958	483	89.5	125.5	8.0	73.7	72.1	53.4	39.3
1959	509	89.0	116.6	8.8	81.3	80.2	57.6	46.8
1960	538	88.0	122.1	9.9	97.0	92.4	68.0	66.0
1961	572	87.0	125.0	9.5	101.2	94.0	60.8	60.9
1962	544	81.5	127.6	9.8	93.5	92.3	60.0	55.7

* *Use of a sterile ram caused a high percentage of dry ewes and a small lamb crop.*

FINEWOOL WEANLING LAMBS

Characteristics of the finewool weanling lambs are presented in Tables 14 and 15. Weaning weight and type and condition scores have been adjusted to a constant age of 120 days and for the effects of age of dam and type of birth and rearing. Staple length has been adjusted to a constant age of 120 days.

Ram lambs averaged approximately four pounds heavier than ewe lambs in 1961 and over five pounds heavier than ewe lambs in 1962. The ram lambs also had slightly better body type and body condition scores than the ewe lambs in both years.

Weaning weights in 1961 and 1962 were almost the same. They were well above the ten year average, 1949-58. However, average weaning weights in 1961 and 1962 are four to six pounds lighter than those recorded in 1960. Staple length in 1961 was much longer than in previous years. 1962 staple lengths were approximately one-half a centimeter shorter than in 1961. Fiber diameter has remained fairly constant year to year.

The lambs in group 13 excel in staple length but have the poorest record in terms of medullated fibers. Group 25, the purebred Targhees, appear to wean the heaviest lambs and have the highest scoring lambs in body type and body condition. This group rates second behind group 13 in staple length. Group 20, the unselected control, rates at the bottom in all traits.

TABLE 14. FACE AND BODY TRAITS OF FINEWOOL WEANLING LAMBS

Year and breeding group No.	Sex	No. of lambs	Weaning weight (lbs.)	Body type score	Body condition score	Face covering score	Color score
1961							
Group 13	Rams	67	68.9	1.94	2.02	-	1.00
20		62	55.0	2.10	2.13	-	1.34
21		75	68.9	1.93	2.09	-	1.08
22		51	65.3	2.12	2.21	-	1.06
25		30	71.6	1.99	2.08	-	1.07
13	Ewes	60	64.5	2.01	2.12	-	1.05
20		71	55.9	2.43	2.41	-	1.35
21		57	64.0	2.00	2.13	-	1.04
22		60	60.7	2.23	2.32	-	1.07
25		42	64.9	2.08	2.19	-	1.07
1962							
Group 13	Rams	53	68.4	2.05	2.09	3.3	1.49
20		42	61.1	2.75	2.79	3.9	1.79
21		52	66.7	2.30	2.28	3.6	1.81
22		60	67.8	2.25	2.24	3.5	1.72
25		30	70.0	1.97	2.00	3.5	1.50
13	Ewes	60	63.1	2.27	2.20	3.1	1.40
20		50	57.3	2.76	2.77	3.7	1.76
21		54	59.9	2.39	2.45	3.6	1.80
22		57	64.8	2.17	2.18	3.3	1.56
25		32	63.0	1.62	2.23	3.4	1.44
Totals and Averages							
1949-58	Rams	1025	59.9	2.93	2.84	2.8	-
	Ewes	1074	55.4	2.94	2.86	2.9	-
1959	Rams	194	59.6	3.29	3.90	3.1	1.10
	Ewes	216	53.6	3.38	3.96	3.0	1.17
1960	Rams	271	72.0	2.94	3.04	3.1	1.24
	Ewes	243	65.4	3.04	3.05	2.8	1.34
1961	Rams	285	65.5	2.01	2.10	-	1.11
	Ewes	290	61.6	2.17	2.25	-	1.13
1962	Rams	237	66.8	2.27	2.28	3.6	1.67
	Ewes	253	61.6	2.29	2.36	2.4	1.60

TABLE 15. FLEECE CHARACTERISTICS OF FINEWOOL WEANLING LAMBS

Year and breeding group No.	Sex	No. of lambs	Fiber traits at side: Staple length (cms.)	Fiber diameter (microns)	Medullated fibers (percent)
1961					
Group 13	Rams	67	5.59	25.50	.62
20		62	2.74	20.80	.24
21		75	4.24	23.30	.30
22		51	4.01	21.90	.01
25		30	4.70	23.30	.17
13	Ewes	60	5.35	27.05	1.85
20		71	2.92	22.77	.21
21		57	4.49	24.78	.52
22		60	3.76	21.83	.06
25		42	4.47	24.30	.15
1962					
Group 13	Rams	53	4.11	24.44	.01
20		42	2.82	24.50	.00
21		52	3.37	20.51	.00
22		60	3.63	25.43	.00
25		30	3.79	22.23	.00
13	Ewes	60	4.61	25.14	.11
20		50	2.72	24.44	.00
21		54	3.42	20.36	.00
22		57	3.50	24.65	.00
25		32	3.93	24.12	.00
Totals & Averages					
1959	Rams	194	3.88	23.41	.09
	Ewes	216	4.25	24.27	.11
1960	Rams	271	2.95	24.42	.05
	Ewes	243	3.22	25.19	.11
1961	Rams	285	4.24	23.00	.30
	Ewes	290	4.11	24.96	.57
1962	Rams	237	3.55	23.24	.00
	Ewes	253	3.63	23.74	.00

SELECTION PRACTICED ON FINEWOOL WEANLING LAMBS

Selection differentials, the relative emphasis placed on each trait, and the expected genetic gains per generation are summarized in table 16. The selection differentials represent the average differences between the selected lambs and all lambs weaned after corrections for environmental influences have been made. Positive selection differentials for weaning weight are highly desirable and indicate selection of animals above average for this trait. With staple length, a positive selection differential is normally desirable, however, in these lambs a negative value for staple length usually indicates selection against the longer, coarser, and shaggier fleeces. Negative selection differentials for fiber diameter indicate selection of animals with finer fleeces, which is desirable. For all other traits, which are measured by the scoring method, the signs have been reversed so that a positive selection differential represents selection for the superior animals. The zero or very low selection differentials for color and outercoat scores indicate that the group is free or nearly free of these objectionable traits.

The relative emphasis placed on each trait, sometimes called the relative intensity of selection, is obtained by dividing the selection differential by the standard deviation.

The expected genetic gain per generation from selection in only one sex is the selection differential times one-half of the heritability. The sum of the products for both sexes gives the net expected genetic gain per generation from selection practiced at weanling age on both sexes. These are only tentative gains, however, because not all lambs saved at weaning will be permitted to produce offspring. This is especially true in the rams where considerable selection is practiced at later ages, but in the ewes most of the effective selection is made at weaning age.

All rams are culled in groups 21 and 22. Ewes saved from these groups are mated to rams obtained from other sources. The rams in groups 20, the control group, are selected at random, and it is noted that the selection differentials are generally quite small. It could not be expected that random selection would give zero selection differentials for all traits. Over a period of years, however, the positive selections should be more or less balanced by the negative selections. The ewe lambs in group 20 are also selected at random at weanling age.

Heritability estimates for all traits except face covering, color and outercoat scores were computed from the records of Navajo and Navajo crossbred lambs produced from 1947 to 1953, inclusive. They are applicable to the extent that they are still representative of the present sheep. The heritability estimate for face covering score is that obtained on range Targhee and Columbia lambs at the U. S. Sheep Experiment Station, Dubois, Idaho. Thus the estimate of the expected genetic gains per generation for face covering score is accurate only to the extent that the Dubois heritability estimate is representative of the lambs at this station. Heritabilities for color and outercoat scores have not been computed.

TABLE 16. SELECTION PRACTICED ON FINE WOOL WEANLING LAMBS

	Year	Sex	Breeding group number	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Color score	Percent saved
Heritability				0.21	0.04	0.11	0.06	0.30	0.46	-	-
Selection differential	1961	Rams	13	2.33	0.02	0.11	- .05	0.10	-	0.02	42%
			20	0.40	- .14	- .05	- .05	0.80	-	- .16	27%
			21			NO RAMS SAVED					
			22			NO RAMS SAVED					
			25	- .08	0.00	0.00	- .01	0.00	-	- .07	97%
		Ewes	13	- .07	- .01	- .02	- .08	- .10	-	0.03	88%
			20			ALL EWES SAVED					
			21	2.00	0.08	0.13	0.03	0.01	-	0.03	65%
			22	1.19	0.03	0.03	0.02	0.20	-	0.00	84%
			25	0.20	0.01	0.02	0.03	0.01	-	- .07	98%
	1962	Rams	13	3.87	0.14	0.12	0.29	- .30	- .10	0.17	47%
			20	2.67	0.12	0.25	- .04	0.10	0.02	0.00	33%
			21			NO RAMS SAVED					
			22			NO RAMS SAVED					
			25	0.86	- .04	0.00	- .03	- .24	0.06	0.00	73%
		Ewes	13	5.61	0.11	0.11	0.14	- .51	0.16	0.03	50%
			20	0.03	0.01	0.09	0.00	0.29	0.00	0.00	50%
			21	4.49	0.18	0.22	0.27	- .08	0.16	0.03	46%
			22	2.54	0.06	0.07	0.16	0.00	0.32	- .07	45%
			25	3.76	0.12	0.18	0.08	- .22	0.09	0.07	87%

TABLE 16, CONT. SELECTION PRACTICED ON FINE WOOL WEANLING LAMBS

	Year	Sex	Breeding group number	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Color score	Percent saved
Relative emphasis	1961	Rams	13	0.2298	0.0205	0.5090	-.0493	0.0589	-	0.0935	42%
			20	0.0610	-.3015	-.1323	-.0734	0.6379	-	-.2328	27%
			21			NO RAMS SAVED					
			22			NO RAMS SAVED					
			25	-.0102	0.00	0.00	-.0095	0.00	-	-.1916	97%
		Ewes	13	-.0086	-.0359	-.0581	-.1023	-.0479	-	0.1365	88%
			20			ALL EWES SAVED					
			21	0.7991	0.2698	0.3533	0.0708	0.0061	-	0.1819	65%
			22	0.2292	0.1188	0.1145	0.0951	0.0839	-	0.00	84%
			25	0.0237	0.0251	0.0540	0.0572	0.0050	-	-.1720	98%
	1962	Rams	13	0.6159	0.4633	0.3052	0.3619	-.1247	-.1527	0.3368	47%
			20	0.0610	-.3015	-.1323	-.0734	0.6379	0.0212	-.2328	33%
			21			NO RAMS SAVED					
			22			NO RAMS SAVED					
			25	0.0906	-.1171	0.00	-.0626	-.1076	0.0880	0.00	73%
		Ewes	13	0.6662	0.3545	0.3212	0.1753	-.2198	0.2142	0.0569	50%
			20	0.0042	0.0300	0.1793	0.00	0.1363	0.00	0.00	50%
			21	0.5796	0.4844	0.4963	0.3555	-.0412	0.2377	0.0792	46%
			22	0.3977	0.1595	0.1496	0.2296	0.00	0.4073	-.2607	45%
			25	0.3064	0.2249	0.2710	0.0774	-.0888	0.1364	0.5032	87%

TABLE 16, CONT. SELECTION PRACTICED ON FINE WOOL WEANLING LAMBS

	Year	Sex	Breeding group number	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Percent saved
Expected genetic gain	1961	Rams	13	0.2477	0.0004	0.0061	0.0015	0.0150	-	42%
			20	0.0420	-.0028	-.0028	-.0015	0.1200	-	27%
			21			NO RAMS SAVED				
			22			NO RAMS SAVED				
			25	-.0084	0.00	0.00	-.0315	0.00	-	97%
		Ewes	13	-.0073	-.0002	-.0011	-.0024	-.0150	-	88%
			20			ALL EWES SAVED				
			21	0.2100	0.0016	0.0071	0.0009	0.0015	-	65%
			22	0.1249	0.0006	0.0017	0.0006	0.0300	-	84%
			25	0.0210	0.0002	0.0011	0.0009	0.0015	-	98%
	1962	Rams	13	0.4063	0.0028	0.0066	0.0087	-.0450	-.0230	47%
			20	0.2803	0.0024	0.0137	-.0012	0.0150	0.0046	33%
			21			NO RAMS SAVED				
			22			NO RAMS SAVED				
			25	0.9970	-.0008	0.00	-.0009	-.0360	0.0138	73%
		Ewes	13	0.5890	0.0022	0.0605	0.0042	-.0765	0.0037	50%
			20	0.0031	0.0002	0.0049	0.00	0.0435	0.00	50%
			21	0.4715	0.0036	0.0121	0.0081	-.0120	0.0368	46%
			22	0.2667	0.0012	0.0038	0.0048	0.00	0.0736	45%
			25	0.3948	0.0024	0.0099	0.0024	-.0330	0.0207	87%

FINEWOOL YEARLING EWES AND RAMS

Characteristics of the finewool yearling ewes and rams are presented in Tables 17 and 18. Body weights and type and condition scores were recorded in June at approximately 400 days of age. All other traits were measured in April at shearing time, or a few days before. Body weights have been adjusted to 400 days of age, while staple length and fleece weights have been corrected to 365 days of age. In addition, these traits in the ewes have also been adjusted for the effects of age of dam and type of birth and rearing. Correction factors for the yearling rams have not been determined.

Body weight in the improved groups continues to show gradual improvement. The unselected controls (group 20) tend to fluctuate around 82 pounds for the ewes and 110 pounds for the rams. Average staple lengths have risen steadily since 1959. In 1962, grease fleece weight of the rams was below 1961 but clean fleece weight was higher. This would indicate cleaner, lower shrinking fleeces in 1962.

TABLE 17. BODY WEIGHTS AND SCORES OF FINEWOOL YEARLINGS

Year	Sex	Breeding group number	No.of sheep	Body weight (lbs.)	Body type score	Body condition score	Face covering score	Color score
1961	Rams	13	15	125.3	1.64	1.70	2.35	1.00
		20	13	113.3	2.29	2.25	3.34	1.00
		25	19	124.3	1.49	1.30	2.98	1.00
	Ewes	13	47	88.5	2.24	2.19	2.25	1.06
		20	60	83.0	2.65	2.67	2.51	2.22
		21	31	84.4	2.42	2.34	2.95	1.00
		22	41	88.0	2.33	2.20	2.30	1.05
		25	17	83.4	2.15	2.20	2.18	1.00
1962	Rams	13	24	125.0	1.85	1.76	2.41	1.14
		20	10	110.0	2.68	2.51	3.66	2.37
		25	28	131.0	1.75	1.61	3.48	1.03
	Ewes	13	53	88.9	2.13	1.98	2.56	1.06
		20	72	82.1	2.62	2.40	3.41	1.39
		21	38	89.5	2.22	2.02	3.35	1.07
		22	47	89.5	2.19	2.01	2.86	1.04
		25	39	90.3	2.06	1.96	2.84	1.03
Totals and averages								
1959	Rams		41	115.5	2.91	2.49	3.01	1.29
	Ewes		154	88.7	2.79	2.35	2.49	1.29
1960	Rams		38	128.6	2.22	1.85	2.24	1.24
	Ewes		184	90.5	2.65	2.56	2.13	1.20
1961	Rams		47	119.1	1.71	1.65	2.88	1.13
	Ewes		196	86.2	2.40	2.39	2.46	1.40
1962	Rams		62	125.6	1.94	1.82	3.10	1.18
	Ewes		249	87.0	2.27	2.10	3.05	1.15

TABLE 18. FLEECE CHARACTERISTICS OF FINEWOOL YEARLINGS

Year	Sex	Breeding group number	No. of sheep	Fleece weights Grease (lbs.)	Fleece weights Clean (lbs.)	Staple length (cms.)	Fiber diameter (microns)	Outer-coat score	Percent medullated fibers
1961	Rams	13	15	9.81	4.95	9.73	24.1	1.00	-
		20	13	6.30	3.11	5.61	22.2	1.00	-
		25	19	8.90	4.24	8.72	22.7	1.00	-
	Ewes	13	47	6.63	3.12	8.66	23.3	1.02	-
		20	60	5.08	2.35	5.69	21.3	1.00	-
		21	31	6.90	2.93	7.18	20.3	.99	-
		22	41	6.50	3.05	7.73	22.1	1.00	-
		25	17	6.26	2.98	7.67	22.8	.99	-
1962	Rams	13	24	7.98	4.90	9.70	22.7	1.07	.02
		20	10	5.74	3.63	6.50	21.6	.92	.01
		25	28	8.24	4.68	8.80	20.4	1.03	.01
	Ewes	13	53	6.67	3.64	10.36	23.6	1.40	.00
		20	72	5.52	2.99	6.67	21.7	1.07	.00
		21	38	6.88	3.48	8.11	20.2	1.08	.00
		22	47	6.93	3.66	8.42	21.4	1.05	.00
		25	39	6.85	3.52	8.76	20.0	1.09	.00
Totals & Averages									
1959	Rams		41	6.37	3.20	7.20	21.6	1.00	.00
	Ewes		154	6.36	2.93	7.19	20.1	1.06	.03
1960	Rams		38	7.33	3.41	7.44	24.4	1.04	.01
	Ewes		187	6.82	3.32	6.60	22.5	1.01	.04
1961	Rams		47	8.47	4.17	8.18	23.0	1.00	-
	Ewes		196	6.11	2.83	7.24	22.6	1.01	-
1962	Rams		62	7.79	4.60	8.81	21.2	.99	.01
	Ewes		249	6.45	3.43	8.35	21.7	1.15	.00

IMPROVEMENT OF COARSE WOOL SHEEP FOR THE PRODUCTION OF WOOL SUITABLE FOR NAVAJO HAND WEAVING

The objectives of this project are to develop and improve crossbred sheep producing quarter, or low quarter blood wool, suitable for Navajo hand weaving, which are adapted to southwestern ranges, and to provide a source of rams for Navajo producers of weaving wool. Part of the wool produced by Navajos is woven into rugs and blankets, which adds to their rather meager income. Consequently, production of wool suitable for hand weaving is still important to the Navajo enconomy. Emphasis has been placed on selecting breeding animals displaying hardiness, adaptability, body size, good staple length, and clean wool production.

TABLE 19. CHARACTERISTICS OF COARSEWOOL BREEDING RAMS, AS YEARLINGS

Year and breeding group No.	No. of rams	Age at lambing (years)	Yearling body weight (lbs.)	Yearling fleece weights Grease (lbs.)	Yearling fleece weights Clean (lbs.)	Fiber traits at side: Staple length (cms.)	Fiber traits at side: Fiber diameter (microns)	Fiber traits at side: U.S. grade	Fiber traits at side: Medullated fibers (percent)
1961									
Group 16	4	2.0	147.0	8.02	4.31	11.7	31.4	50's	0.00
23	10	2.5	136.5	7.04	3.89	11.3	29.4	54's	1.44
1962									
Group 16	5	2.6	144.0	7.93	4.60	12.0	28.3	56's	0.00
23	11	2.3	137.7	8.21	5.05	11.9	29.4	54's	0.00
Totals and averages									
1950-56	118	3.4	121.7	8.56	5.03	12.2	30.1	50's	0.03
1957-61	68	2.6	110.8	6.33	3.84	10.9	27.1	56's	1.20
1961	14	2.4	135.2	7.33	4.00	11.4	30.6	54's	1.03
1962	16	2.4	139.7	8.13	4.91	11.9	29.1	54's	0.00

COARSEWOOL BREEDING FLOCK

Characteristics of the coarsewool rams and ewes that were used for breeding in the years 1961 and 1962 are presented in Tables 19 and 20. The rams that were used in groups 16 and 23 are of the same breeding, and were produced in group 16. The procedure has been to select the four phenotypically best yearling rams each fall for use in group 16. If these rams produce satisfactory progeny, they are used the following year in breeding group 23. The remainder of the ten sires used in group 23 are made up of the second choice yearling and mature rams from group 16.

The breeding ewes of group 23 are composed of offspring of average Navajo reservation ewes bred to group 16 rams. Most of the ewes are second and third crosses. The ewes in group 23 are approaching group 16 in all traits except fiber diameter and staple length. As more third and fourth crosses are used in the breeding flock, all traits of group 23 ewes should become approximately equal to the corresponding traits of group 16 ewes.

TABLE 20. CHARACTERISTICS OF COARSEWOOL BREEDING EWES, AS YEARLINGS

Year and breeding group No.	No. of ewes	Age at lambing (years)	18 Mos. body weight (lbs.)	Yearling fleece weight Grease (lbs.)	Yearling fleece weight Clean (lbs.)	Fiber traits at side: Staple length (cms.)	Fiber traits at side: Fiber diameter (microns)	Fiber traits at side: U.S. grade	Fiber traits at side: Medullated fibers (percent)
1961									
Group 16	119	4.0	107.6	5.76	3.34	10.4	26.2	58's	0.30
23	107	3.9	107.6	5.63	3.23	7.8	23.9	62's	0.28
1962									
Group 16	111	3.7	110.6	5.76	3.37	10.1	27.9	56's	0.33
23	110	3.6	108.4	5.82	3.42	8.2	25.6	58's	0.20
Totals and averages									
1950-56	2778	4.1	102.7	6.50	3.60	10.2	-	60's	0.55
1957-61	1058	3.8	103.7	5.38	3.04	8.9	23.8	62's	0.16
1961	226	4.0	107.6	5.70	3.29	9.2	25.1	60's	0.17
1962	221	3.6	109.5	5.79	3.39	9.1	26.7	58's	0.17

LAMB PRODUCTION OF COARSEWOOL MATINGS

Table 21 summarizes the lamb production of the coarsewool ewes for the years 1961 and 1962. For the period 1937 through 1951, the percent of ewes lambing is based on the number of ewes bred and surviving to lambing time. The newer method of computation gives an indication of fertility that is not confounded with post-breeding death losses. However, this percentage is affected by the fertility of both rams and ewes. The percent of lambs born minus 100 gives the rate of twin births. The percent of lambs weaned of live lambs born measures the survival rate of lambs from birth to weaning age. Prior to 1947, average weaning weights and pounds of lamb weaned per ewe bred were based on weights taken at about 140 days of age and unadjusted for any measurable environmental factors. From 1947 to date, the weights are adjusted to a constant age of 120 days and are corrected for age of dam and type of birth and rearing.

TABLE 21. LAMB PRODUCTION OF COARSEWOOL MATINGS

Year and breeding group No.	No. of ewes bred	Percent of ewes lambing	Percent lambs born of ewes lambing	Average birth weight (lbs.)	Percent lambs weaned of: ewes bred	Percent lambs weaned of: lambs born alive	Average weaning weight (lbs.)	Pounds of lamb per ewe bred
1937-41	1216	88.3	126.0	-	97.1	88.8	59.9	58.2
1942-46	1794	79.8	140.6	-	89.4	81.3	59.4	53.1
1947-51	3864	79.4	129.0	-	76.6	76.2	57.9	44.3
1952-56	1822	89.4	115.0	-	81.0	84.3	60.1	48.6
1957-61	1060	86.5	118.3	9.13	90.5	89.8	64.0	56.9
1961								
Group 16	120	60.8	124.7	9.93	71.7	94.5	69.3	47.0
23	107	84.1	130.0	9.83	99.1	95.6	68.4	64.0
1962								
Group 16	111	89.2	128.3	9.99	100.0	91.7	65.2	65.2
23	110	78.2	129.1	10.34	89.1	88.3	63.8	56.9

COARSEWOOL WEANLING LAMBS

Fleece and body characteristics of the coarsewool weanling lambs are summarized in Tables 22 and 23. Weaning weights and type and condition scores are adjusted to a constant age of 120 days and for the effects of age of dam and type of birth and rearing. Staple length is corrected to a constant age of 120 days.

Weaning weights in 1961 and 1962 are well above those of previous years, with the exception of 1960. The 1960 weights were the heaviest ever recorded

Color scores, body type and body condition scores show continued improvement over previous years. This improvement in scores is not directly comparable year to year, however. The score recorded for an animal is an average of the score given the animal by each member of a three-man committee. The committee members differ each year, but all scores recorded within one year are by the same committee. This would make scores of different breeding groups within a year comparable.

Percent medullated fibers increased considerably in 1961, then dropped sharply in 1962. No apparent reason can be given for these changes.

TABLE 22. FACE AND BODY TRAITS OF COARSEWOOL WEANLING LAMBS

Year and breeding group No.	Sex	No. of lambs	Adjusted: Weaning weight (lbs.)	Adjusted: Body type score	Adjusted: Body condition score	Face covering score	Color score
1957							
Group 16	Rams	35	66.2	2.37	2.66	2.85	1.69
23		46	68.0	2.39	2.43	3.05	1.87
16	Ewes	46	59.8	2.48	2.60	2.77	1.67
23		27	61.0	2.43	2.57	2.75	2.11
1958							
Group 16	Rams	32	54.7	3.03	3.50	2.83	1.63
23		47	56.9	3.04	3.60	3.05	1.80
16	Ewes	46	54.2	3.27	3.47	2.76	1.57
23		40	53.3	2.97	3.49	2.82	1.85
1959							
Group 16	Rams	55	59.7	3.33	4.03	2.77	1.49
23		54	60.4	3.19	3.82	2.90	1.57
16	Ewes	50	54.0	3.40	4.06	2.68	1.58
23		47	56.2	3.28	3.94	2.52	1.49
1960							
Group 16	Rams	57	74.0	2.84	3.13	2.58	1.44
23		66	73.5	2.78	3.05	2.57	1.27
16	Ewes	60	67.6	2.84	3.15	2.43	1.53
23		55	65.0	2.90	3.13	2.53	1.33
1961							
Group 16	Rams	47	72.7	2.00	2.07	-	1.39
23		51	69.8	1.80	1.93	-	1.08
16	Ewes	36	64.8	2.08	2.19	-	1.42
23		56	65.8	2.03	2.16	-	1.17
1962							
Group 16	Rams	57	69.9	2.03	2.13	3.36	1.19
23		47	70.1	2.04	2.12	3.45	1.38
16	Ewes	50	67.9	2.06	2.24	3.16	1.28
23		48	64.9	2.09	2.15	3.17	1.19

TABLE 23. FLEECE CHARACTERISTICS OF COARSEWOOL WEANLING LAMBS

Year and breeding group No.	Sex	No. of lambs	Staple length (cms.)	Fiber diameter (microns)	Medullated fibers (percent)	Kemp fibers (percent)
1957						
Group 16	Rams	35	6.13	30.5	3.46	.02
23		46	3.81	27.0	2.41	.08
16	Ewes	36	6.39	30.3	2.21	.00
23		27	3.70	25.3	.36	.00
1958						
Group 16	Rams	32	5.77	27.4	.72	.00
23		47	3.84	26.4	.57	.02
16	Ewes	46	6.30	28.5	.44	.00
23		40	4.87	25.4	.15	.01
1959						
Group 16	Rams	55	6.68	30.2	2.97	.15
23		54	5.41	27.7	.82	.00
16	Ewes	50	7.32	31.5	3.09	.28
23		47	6.14	31.1	.91	.00
1960						
Group 16	Rams	57	4.74	31.0	.14	.00
23		66	3.92	28.8	.34	.00
16	Ewes	60	5.67	33.2	.23	.01
23		55	4.40	29.6	1.28	.00
1961						
Group 16	Rams	47	7.38	29.3	4.86	*-
23		51	5.80	29.0	3.88	-
16	Ewes	36	6.75	31.1	5.56	-
23		56	6.43	30.7	4.12	-
1962						
Group 16	Rams	57	6.10	28.0	.02	-
23		47	5.38	28.6	.03	-
16	Ewes	50	6.24	28.0	.06	-
23		48	5.41	29.8	.02	-

SELECTION OF COARSEWOOL WEANLING LAMBS

Selection differentials, the relative emphasis placed on each trait, and the expected genetic gains per generation are presented in table 24. As noted for the previous sections: the selection differential is the difference between the average of the saved lambs and the average of all lambs from which they were selected; the relative emphasis is the ratio of the selection differential to the standard deviation; and the expected genetic gain per generation in one sex is one-half the heritability times the selection differential. Where selection is practiced in both sexes, the expected genetic gain per generation is the sum of the values of the two sexes. Naturally these are only tentative gains, since all animals selected will not produce offspring.

For all traits that are measured by means of scores, the signs have been reversed so that a positive value indicates improvement for that trait. In the other traits which are measured quantatively (weaning weight, staple length, and fiber diameter), the signs are untouched, so that a positive value means an increase in the unit of measurement for that trait. Greatest emphasis has been placed on weaning weight, type, condition and outercoat scores. Since only about one-third of the ram lambs are saved each year, it has been possible to exert greater selection pressure on them than on the ewe lambs, where two thirds or more are saved each year.

TABLE 24. SELECTION PRACTICED ON COARSEWOOL WEANLING LAMBS

	Year	Sex	Breeding group number	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Color score	Percent saved
Heritability				0.21	0.04	0.11	0.06	0.30	0.46	-	
Selection differential	1961	Rams	16	1.62	0.12	0.18	1.36	0.20	-	0.19	34%
			23			ALL RAMS CULLED					
		Ewes	16	1.28	0.01	0.06	- .003	0.20	-	0.09	67%
			23	1.39	0.04	0.05	- .24	0.2	-	0.13	43%
	1962	Rams	16	6.13	0.18	0.18	0.61	0.66	0.26	- .04	27%
			23			ALL RAMS CULLED					
		Ewes	16	2.88	0.01	0.03	0.44	0.40	- .04	0.07	60%
			23	5.93	0.22	0.26	0.53	1.35	0.10	0.00	54%
Relative emphasis	1961	Rams	16	0.1894	0.3996	0.4512	- .0999	0.0827	-	0.3757	27%
		Ewes	16	0.1648	0.0399	0.5150	- .0026	0.0781	-	0.1793	60%
			23	0.2134	0.1363	0.1838	- .1810	0.0960	-	0.3891	54%
	1962	Rams	16	0.8229	0.4622	0.4451	0.4295	0.3128	0.3589	- .0966	27%
		Ewes	16	0.4421	0.0285	0.0951	0.1914	0.1724	- .0821	0.0890	60%
			23	0.4017	0.4691	0.4714	0.4274	0.4909	0.1284	0.0	54%

TABLE 24, CONT. SELECTION PRACTICED ON COARSEWOOL WEANLING LAMBS

	Year	Sex	Breeding group number	Weaning weight (lbs.)	Type score	Condition score	Staple length (cms.)	Fiber diameter (microns)	Face covering score	Percent saved
Expected genetic gain	1961	Rams	16	0.1701	0.0024	0.0099	- .0007	0.0300	-	27%
		Ewes	16	0.1344	0.0002	0.0033	- .0001	0.0300	-	60%
			23	0.6837	0.0008	0.0033	0.0072	0.0300	-	54%
	1962	Rams	16	0.6436	0.0036	0.0099	0.0183	0.0990	0.0598	27%
		Ewes	16	0.3024	0.0002	0.0016	0.0132	0.0600	- .0092	60%
			23	0.6227	0.0044	0.0143	0.0159	0.2025	0.0230	54%

COARSEWOOL YEARLING TRAITS

Fleece and body characteristics of the coarsewool yearling rams and ewes are shown in Tables 25 and 26. Steady improvement has continued in all fleece traits. Fiber diameter was too fine in the 1962 group 16 ewes, however. There is a considerable amount of yearly variation in body weights, due to environmental influences. However, the general trend is toward heavier weights.

TABLE 25. BODY WEIGHTS AND SCORES OF COARSEWOOL YEARLINGS

Year	Sex	Breeding group number	No. of sheep	Body weight (lbs.)	Body type score	Body condition score	Face covering score	Color score
1959	Rams	16	13	111.7	2.82	3.06	2.50	1.46
	Ewes	16	30	89.9	2.93	2.76	2.07	1.63
		23	28	90.7	2.79	2.43	2.10	1.71
1960	Rams	16	15	139.6	1.90	1.92	1.68	1.27
	Ewes	16	32	91.8	2.66	2.60	1.49	1.47
		23	35	95.9	2.67	2.71	1.64	1.49
1961	Rams	16	20	125.7	1.96	2.05	2.20	1.12
	Ewes	16	37	93.9	2.37	2.65	2.66	1.28
		23	35	88.4	2.39	2.56	2.07	1.28
1962	Rams	16	15	132.0	2.05	1.94	2.13	1.61
	Ewes	16	24	93.1	2.13	2.20	2.60	1.35
		23	23	96.2	2.10	2.11	2.73	1.13

TABLE 26. FLEECE CHARACTERISTICS OF COARSEWOOL YEARLINGS

Year	Sex	Breeding group number	No. of sheep	Fleece weights Grease (lbs.)	Fleece weights Clean (lbs.)	Staple length (cms.)	Fiber diameter (microns)	Outer-coat score	Percent medullated fibers
1959	Rams	16	13	5.98	3.56	11.8	28.4	1.23	.04
	Ewes	16	30	5.89	3.30	10.2	24.6	1.62	.00
		23	28	5.82	3.28	8.8	23.1	1.26	.03
1960	Rams	16	15	7.85	4.08	11.9	30.7	1.41	.53
	Ewes	16	32	6.49	3.70	10.5	28.8	1.40	.40
		23	35	6.60	4.05	8.5	26.4	1.11	.02
1961	Rams	16	20	8.07	5.13	11.8	29.1	1.11	-
	Ewes	16	37	5.30	3.31	10.4	29.9	1.24	-
		23	35	5.64	3.37	8.9	27.6	1.07	-
1962	Rams	16	14	8.39	5.18	12.2	27.9	1.23	.05
	Ewes	16	23	6.28	3.73	11.4	24.9	2.01	.00
		23	23	6.12	3.77	10.4	27.8	1.61	.00